Child and Teen Welfare in Missouri: Does the Economy Play a Role?

RESEARCH AND PLANNING REPORT

Report RAP-0301-1
March 2001

RESEARCH AND PLANNING
Missouri Economic Development

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Key Findings

The Index of **Children At Risk** measures the environmental conditions present that may affect the economic and social well-being of children. It appears that children are most at risk in southern Missouri, particularly in the Bootheel region. Children are least at risk in northwestern Missouri and in areas along the eastern portion of the Missouri River.

Roughly 37% of children at risk scores in rural Missouri can be explained by three factors. It appears that children are least at risk in areas that have highly educated populations, lower job growth between 1990-2000, and higher per capita incomes. The results of this analysis indicate that economic conditions play a moderate role in explaining the incidence of at risk children in rural Missouri.

The Index of **Child Abuse and Neglect** measures the occurrence of child abuse and neglect across counties. It appears that children are most at risk for child abuse/neglect in St. Louis City, southwest Missouri, south central Missouri, and northeast Missouri. Children appear least at risk in northwest Missouri, in portions of south central Missouri, and in areas along the Mississippi River.

It was found that rural economies with a high percentage of service jobs may result in a higher incidence of child abuse/neglect, which is supported by the literature. However, since the model predicts only 10.5% of the variance in child abuse/neglect scores, this finding should be taken with caution. In short, the results of this analysis indicate that economic conditions play a very minor role in explaining the incidence of child abuse/neglect in rural Missouri.

The Index of **Teen Violent Death** measures the rate of violent deaths to teens due to accidents, homicides and suicides. It appears that teens are most at risk for violent death in St. Louis City, southeast Missouri, and in extreme northern Missouri. Teens are least at risk in the metropolitan areas of the state and in central and southwest Missouri. In general, teen violent death is diffused throughout the state.

Roughly 39% of teen violent death rates in rural Missouri can be explained by three factors. It appears that teens are least at risk from violent death in areas that are not dependent on agriculture or forestry, that have higher per capita incomes, and that are more highly educated. The results of this analysis indicate that economic conditions play a moderate role in explaining teen violent death rates in rural Missouri.

I. Overview

A central question within many economic development agencies is whether the economy has any impact on various social conditions. Researchers have devised a plethora of methods to quantify social indicators (Ellwood 2000; Kusmin et al. 1994; Nord 1997). However, many of these methods are limited in terms of: (1) data availability; (2) regional specificity; (3) longitudinal data; and (4) statistical reliability. In order to address these limitations, Research and Planning with the Missouri Department of Economic Development created several indicators of child and teen welfare. These indicators will allow policy makers to track the current state of child and teen well-being at the county level over time.

This analysis employs a methodology to addresses the limitations outlined above. The data used in the analysis is from the Office of Social and Economic Data Analysis at the University of Missouri, and is called KidsCount Missouri. Supported in part by the Annie E. Casey Foundation, this data is readily available at the county level and has been collected on an annual basis since 1995. In short, the KidsCount Missouri data offers the most consistent tracking of child and teen well-being in Missouri.

Factor analytic statistical techniques were employed to group the KidsCount Missouri data into several distinct indices. These indices have the advantage of being statistically derived and possessing statistical reliability. Further, many of the indices are composed of several variables, thus making them more robust indicators than any single variable. Also, ordinary least squares regression was used to determine what economic factors predict child and teen well-being.

There are three main objective of this report. First, these findings will allow policy makers to assess the current state of child and teen welfare in their area. Second, this report will allow policy makers to see changes in child and teen welfare over time. Third, this report will allow policy makers to see what impact economic factors have on child and teen welfare. This will allow economic development agencies to ascertain whether the economy has any impact on child and teen welfare. The significance of this report is that it adds some methodological rigor in measuring child and teen welfare because the findings are grounded on sound data and statistical methods.

II. Methods

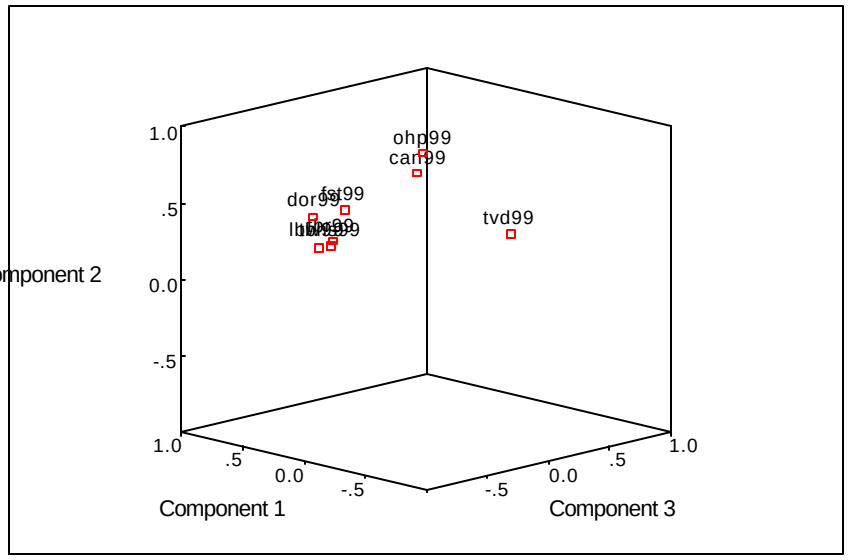
As stated previously, the methodology is based on sound data and rigorous statistical methods. The KidsCount Missouri data used in the analysis comes from the Office of Social and Economic Data Analysis at the University of Missouri. This data has the advantage of being readily available at the county level and has been collected on an annual basis since 1995. It offers the most consistent tracking of child and teen well being in Missouri. This analysis utilizes two main statistical techniques: **factor analysis** and **ordinary least squares regression**. Eight variables were selected for analysis:

- **Births to Mothers without a High School Diploma** – number of live births that occur to women who have less than 12 years of education as indicated on birth certificates. Rate is expressed as a percent of all live births. *Source: Missouri Department of Health*.
- **Low Birth Weight Infants** – number of live infants recorded as having a birth weight under 2,500 grams (5.5 pounds). Rate is expressed as percent of total live births. Data were aggregated over five year periods in order to provide more stable rates. *Source: Missouri Department of Health*.
- **Probable Cause Child Abuse/Neglect** – number of child abuse victims from reports classified as probable cause, indicating that child abuse or neglect has occurred. Rate is expressed per 1,000 children. *Source: Missouri Department of Social Services, US Bureau of the Census, Missouri Office of Administration*.
- **Out-of-Home Placement Entries**– number of entries into Division of Family Services alternative care: including foster care, group homes, relative care and residential settings. Rate is expressed per 1,000 children. *Source: Missouri Department of Social Services, US Bureau of the Census, Missouri Office of Administration*.
- **High School Dropout Rate** – number of students enrolled in public schools who left school without graduating during the school year. Rate is expressed as percent of enrolled students. The formula used to calculate the rate accounts for transfers in and out of a district. *Source: Missouri Department of Elementary and Secondary Education*.
- **Teen Birth Rate** – number of live births that occur to females ages 15 to 19. Rate is expressed per 1,000 females of that age group. *Source: Missouri Department of Health, Missouri Office of Administration*.
- **Teen Violent Death Rate** – number of deaths from homicides, suicides, motor vehicle crashes and other accidents to teens ages 15 to 19. Rate is expressed per 100,000 teens of that age group. Data were aggregated over five year periods in order to provide more stable rates. *Source: Missouri Department of Health, US Bureau of the Census, Missouri Office of Administration*.
- **Children on Food Stamps** – percentage of population under 18 that live in households receiving food stamp benefits. *Source: Missouri Department of Social Services, US Bureau of the Census, Missouri Office of Administration*.

Factor analytic techniques were applied to reduce the eight variables into distinct indices. Both principle components analysis (PCA) and principle factor analysis (PFA) are statistical techniques applied to a single set of variables where the researcher is interested in discovering which variables in the set form coherent subsets that are relatively independent of one another. Variables that are correlated with one another but largely independent of other subsets of variables are combined into factors. Factors are thought to reflect the underlying processes that have created the correlations among variables. The axis is often rotated to maximize variance or covariance between factors.

To begin with, the data met the assumptions to be considered factorable. All eight variables exhibited moderately high correlations (r=0.60 and above); and the Kaiser - Meyer-Olkin Measure of Sampling Adequacy was high (KMO=0.60 and above). An initial PCA was run using oblique rotation, which resulted in no interfactor correlations indicating that an orthogonal rotation was necessary. The PCA orthogonal rotation (varimax method) resulted in three distinct factors - indicated by Eigen values (Eigen=1.0 and above). Factor variable groupings are presented in Figure 1.

Figure 1
Factors in Orthogonally Rotated Space



Where:

TBHS99 is Births to Mothers without a High School Diploma
LBW99 is Low Birth Weight Infants
CAN99 is Probable Cause Child Abuse/Neglect
OHP99 is Out-of-Home Placement Entries
DOR99 is High School Dropout Rate
TBR99 is Teen Birth Rate
TVD99 is Teen Violent Death Rate
FST99 is Children on Food Stamps

The three factors accounted for 70.14% of the variance on the initial eight variables - indicating a good factor solution. Since Drop Out Rates cross loaded on Factors 1 and 3, it was dropped from the solution. Once grouped into factors, variable scores were z-normalized to remove the effect of different scales. Indices were created by summing the z-scores for each index. Reliability analysis was then conducted on each index to ensure consistency. Refer to Figure 2.

The three indicators are:

- **Index of Children At Risk.** This index measures the environmental conditions present that may affect the economic and social well-being of children. The index is comprised of four variables: births to mothers without a high school degree; low birth weight infants; teen birth rate; and children on food stamps. This index has an alpha reliability of α=0.72.
- **Index of Child Abuse and Neglect.** This index measures the occurrence of child abuse and neglect. The index is comprised of two variables: probable cause child abuse and neglect; and out-of-home placement entries. This index has an alpha reliability of α=0.68.
- **Rate of Teen Violent Death.** This variable measures the rate of violent deaths to teens due to accidents, homicides and suicides.

Figure 2
Factor Solution - Orthogonal Rotation

VARIABLE	Children At Risk	Child Abuse/Neglect	Teen Violent Death
Births to Mothers No High School Degree	**.850**	.063	.205
Low Birth Weight Infants	**.699**	.134	-.159
Probable Cause Child Abuse/Neglect	.231	**.758**	-.208
Out-of-Home Placements Entries	.164	**.827**	.178
Drop Out Rate	*.583*	*.110*	*-.524*
Teen Birth Rate	**.809**	.287	.059
Teen Violent Death Rate	.144	.033	**.878**
Children on Food Stamps	**.794**	.319	.063
EIGEN VALUE	**2.939**	**1.477**	**1.195**
PERCENT CUMULATIVE VARIANCE EXPLAINED	**36.734**	**55.198**	**70.136**
ALPHA RELIABILITY	**.717**	**.682**	**-**

Ordinary least squares regression centers on the notion that we wish to predict the value on some variable (known as the endogenous variable) knowing the values of several other variables (known as exogenous variables). Usually, the best guess for predicting a value on the endogenous variable is the mean, but this produces some amount of error due to the inaccuracy of prediction. Regression improves this accuracy by taking into account additional information (control and predictor exogenous variables) in order to more accurately predict values on the endogenous variable.

In order to determine how child and teen welfare depends upon indicators of the economy, an Ordinary Least Squares (OLS) regression is employed in this analysis. The model attempts to predict scores on child and teen welfare indicators given a series of control and predictor variables. The control variables selected are those economic factors that are most likely to affect child and teen welfare, as indicated in the economic development and welfare literature (Bartik and Eberts 1999; Findes and Jensen 1998; Kusmin 1996; Kusmin et al.1994). Although many variables could have been included in the model, only the strongest determinants have been used. Since urban areas possess widely different scores on the child and teen indicators (i.e. St. Charles County has low risk and St. Louis City has high risk), only rural counties were included in the analysis. Refer to Appendix A for additional information regarding the variables used in the model. The model used to predict child and teen welfare is:

$$Y_i = b_0 + b_1PAG + b_2PMFGR + b_3PSERV + b_4PGOVT + b_5PCI + b_6POPDEN + b_7EDUC + b_8EMPCHG$$

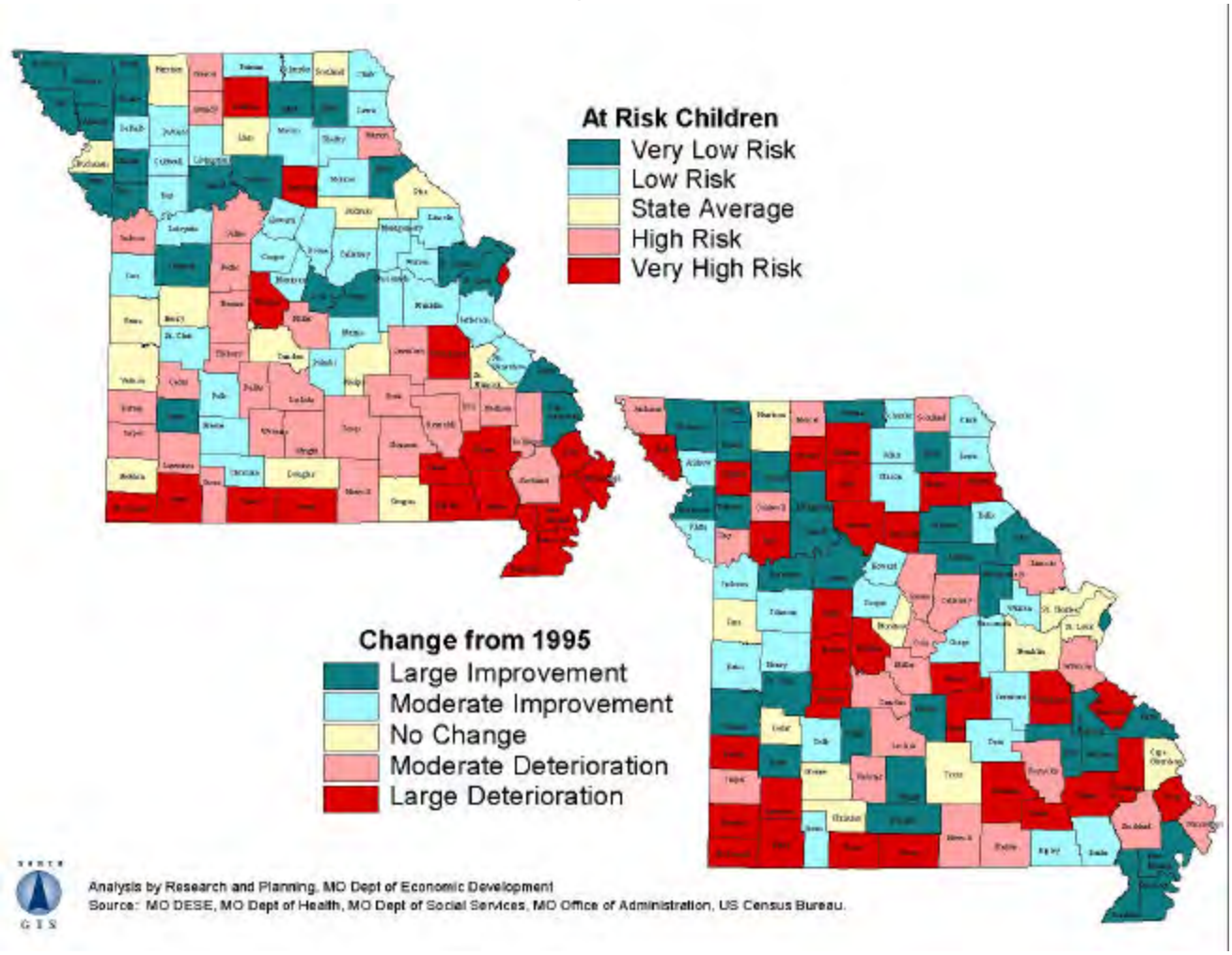
Where:

- **Y_i** is the child and teen welfare indicator for 2000. It is an interval-ratio variable.
  Source: Annie E. Casey Foundation, OSEDA University of Missouri.
- **b_1PAG** is the percent labor force employed in agriculture, forestry and fishing.
  Source: ES-202, Missouri Department of Economic Development.
- **b_2PMFGR** is the percent labor force employed in manufacturing.
  Source: ES-202, Missouri Department of Economic Development.
- **b_3PSERV** is the percent labor force employed in services.
  Source: ES-202, Missouri Department of Economic Development.
- **b_4PGOVT** is the percent labor force employed in government.
  Source: ES-202, Missouri Department of Economic Development.
- **b_5PCI** is per capita income from all sources.
  Source: Bureau of Economic Analysis, US Department of Commerce.
- **b_6POPDEN** is the population density per square mile.
  Source: ESRI and US Bureau of the Census.
- **b_7EDUC** is the percent population with a high school education or higher.
  Source: EASI.
- **B_8EMPCHG** is the change in total employment between 1990 and 1999.
  Source: ES-202, Missouri Department of Economic Development.

III. Children At Risk

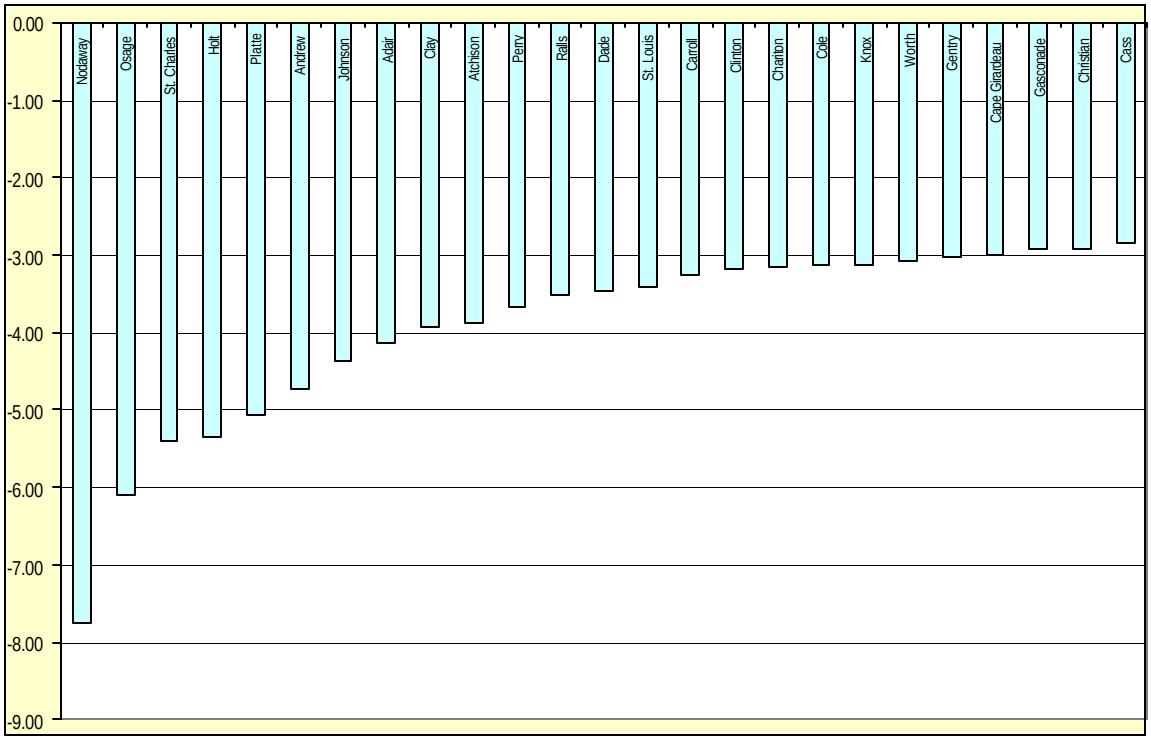
The Index of Children At Risk measures the environmental conditions present that may affect the economic and social well-being of children. High risk indicates that children may live in home environments prone to poverty. This environment may impact a child's future well-being in terms of educational attainment and health status. It appears that children are most at risk in southern Missouri, particularly in the Bootheel region. Children are least at risk in northwestern Missouri and in areas along the eastern portion of the Missouri River. Refer to Map 1.

Map1
Children at Risk, 1995-2000



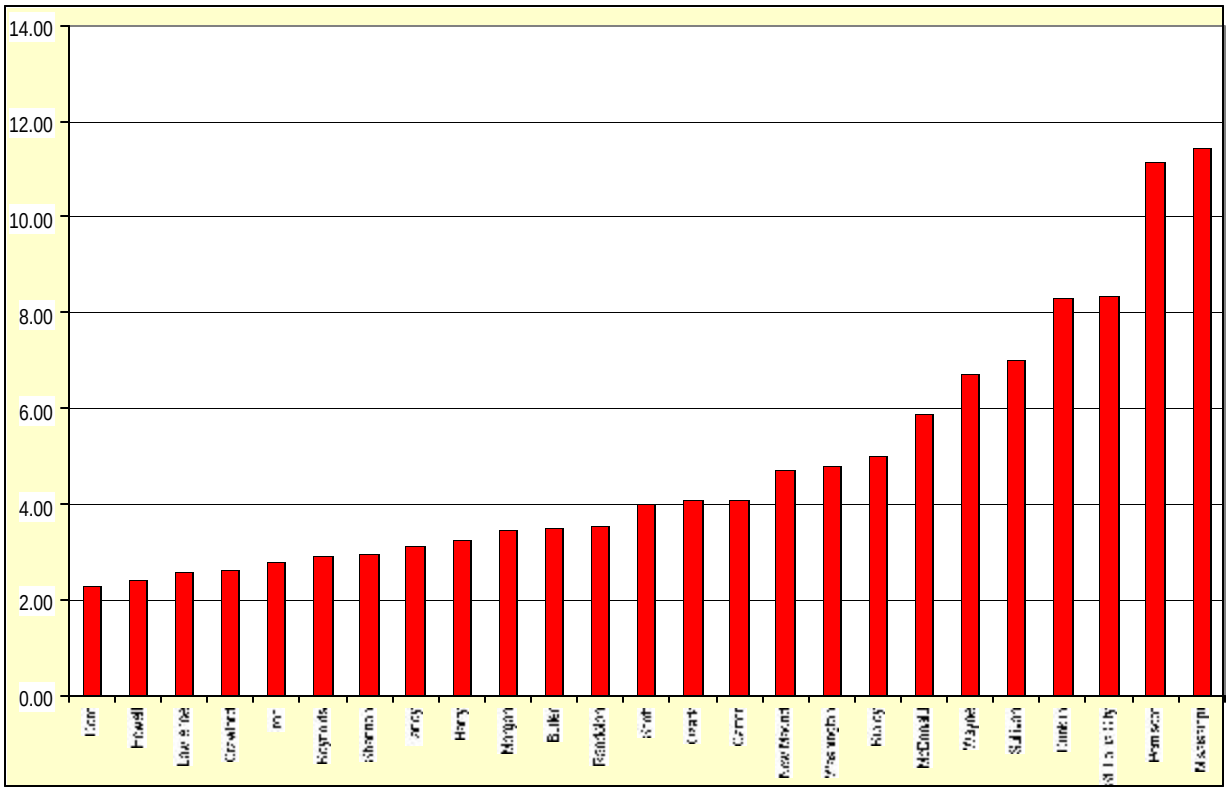
Children are least at risk in four main regions of the state: (1) northwest Missouri; (2) suburban St. Louis; (3) the Cape Girardeau region; and (4) areas along the eastern portion of the Missouri River. The five counties with the lowest risk levels are Nodaway, Osage, St. Charles, Holt, and Platte counties. Generally, suburban areas exhibit low risk because of higher income and educational levels (Ellwood 2000). The northwest region exhibits lower risk because the area is characterized by family-scale farms, which have historically provided stable, albeit lower incomes (Rhodes 1995). Refer to Chart 1.

Chart 1
Children at Risk - Low Risk Counties, 2000
Zero indicates the state average.



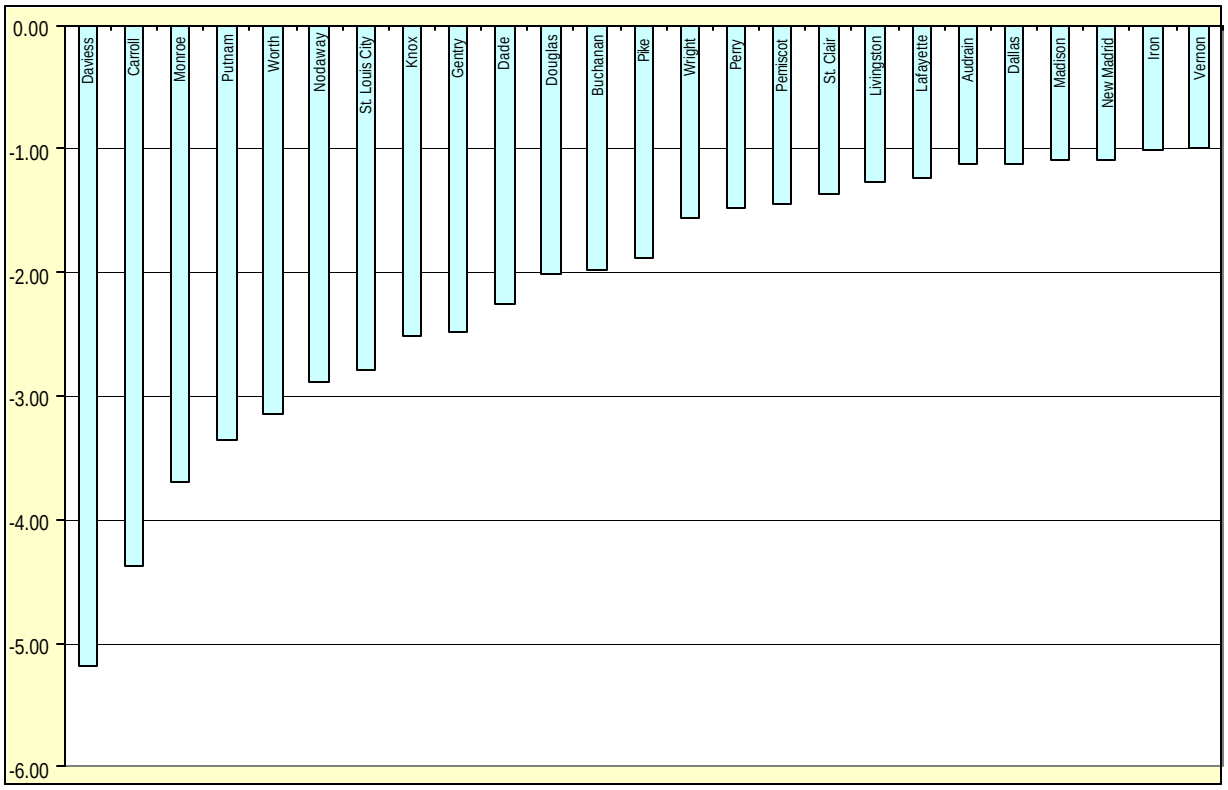
Children are most at risk in four main regions of the state: (1) the Bootheel region; (2) the City of St. Louis; (3) Sullivan County; and (4) most areas in the southern portion of the state. The five counties with the highest risk levels are Mississippi, Pemiscot, St. Louis City, Dunklin, and Sullivan counties. Historically, the Bootheel region has exhibited higher risk because it is classified as persistently poor (Nord 1997). More generally, southern Missouri exhibits higher risk because it has lower levels of income and education than the rest of the state. In Sullivan County, there are several livestock processing plants employing a large number of low-skill migrant workers, many whom speak limited English - resulting in a higher risk factor (Grambling and Freudenberg 1992). Refer to Chart 2.

Chart 2
Children at Risk - High Risk Counties, 2000
Zero indicates the state average.



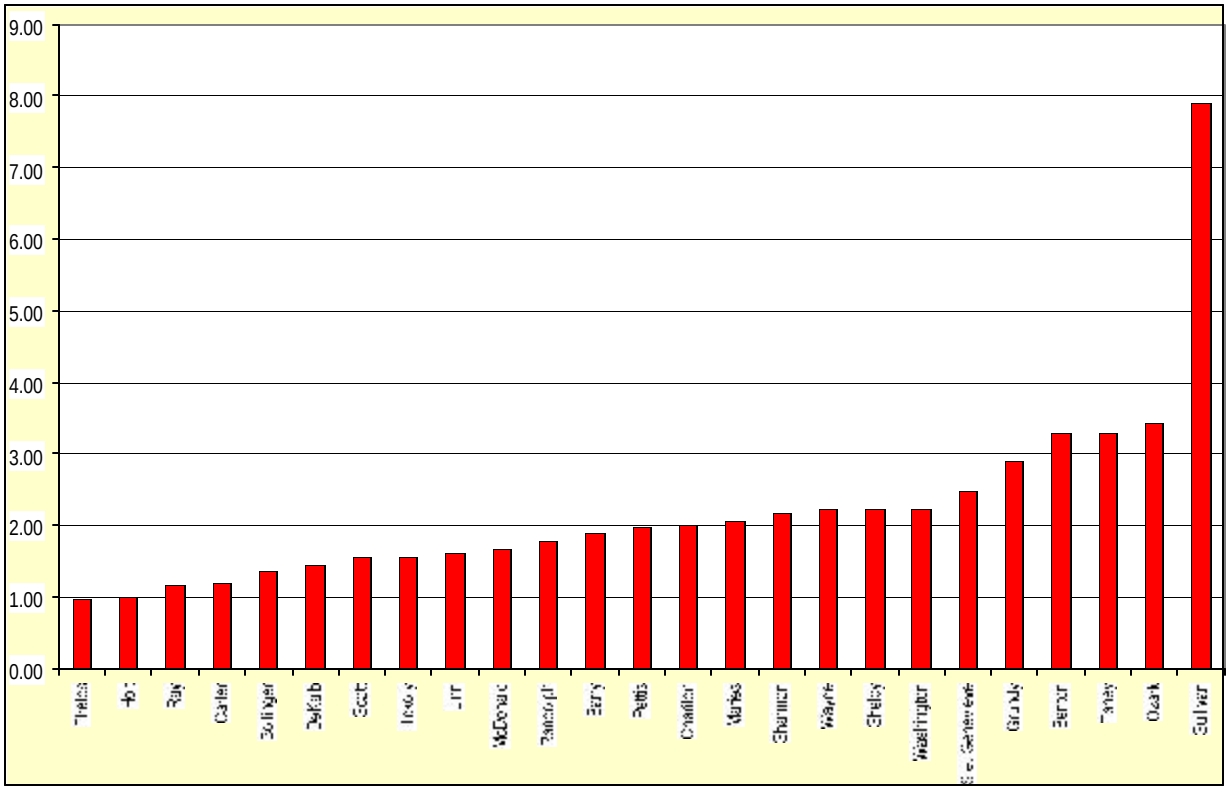
Since 1995, several counties have experienced marked improvement in their children at risk scores. Generally, these counties were concentrated in the Bootheel, west central Missouri, east central Missouri, and northwest Missouri. The five counties with the largest improvement since 1995 are Daviess, Carroll, Monroe, Putnam, and Worth counties. Improvement scores should be noted with caution in that it does not reflect current at-risk conditions. For example, although St. Louis City improved markedly since 1995, it has the third highest risk level for children. Refer to Chart 3.

Chart 3
Children at Risk - High Improvement Counties, 1995-2000
Zero indicates the state average.



Since 1995, several counties have experienced marked deterioration in their children at risk scores. Generally, these counties were concentrated in southwest and central Missouri. The five counties with the largest deterioration since 1995 are Sullivan, Ozark, Taney, Benton, and Grundy counties. These areas are characterized by livestock processing (Milan and Trenton) and recreation/entertainment centers (Branson and Truman Reservoir). There is evidence to support the assertion that corporate agriculture and low wage services jobs contribute to lower socioeconomic conditions (Green 1985; Rhodes 1995). Refer to Chart 4.

Chart 4
Children at Risk - High Deterioration Counties, 1995-2000
Zero indicates the state average.



Regression Model

To determine how economic factors may influence child and teen welfare, an OLS regression model predicting children at risk scores was run on N=93 rural counties in Missouri. As stated previously, urban counties were excluded because they contain outliers on both high and low at risk children (i.e. St. Charles versus St. Louis City). The regression model is highly significant at p=0.0001 ($F_{0.0001}(8,92) = 7.701$), and explains 37.0% ($R^2_{adjusted} = 0.368$) of the variance for children at risk scores in 2000. This indicates that the model predicts children at risk scores with a moderate degree of accuracy.

All OLS assumptions were met for the results to be the best linear unbiased estimates (refer to Appendix A). The following variables were statistically significant predictors of children at risk scores, and are listed according to the strength of their effect. First, it appears that higher percentages of people with a high school education or above in the county (EDUC) decreased children at risk scores ($b^* = -0.495$, $p=0.0001$). Second, increases in employment between 1990 and 2000 (EMPCHG) increased children at risk scores ($b^* = 0.431$, $p=0.056$). Lastly, higher per capita incomes in the county (PCI) decreased children at risk scores ($b^* = -0.323$, $p=0.011$). Refer to Table 1.

Table 1
OLS Regression Model Predicting
Children At Risk in Rural Missouri, 2000

VARIABLE	PARAMETER ESTIMATES			
	Estimate	Std Estimate	T Statistic	Significance
INTERCEPT	11.07800	-	4.717	0.000
PAG - Percent Employed in Agric, Forestry	0.00430	0.010	0.110	0.913
PMFGR - Percent Employed in Manufacturing	0.05744	0.165	1.696	0.094
PSERV - Percent Employed in Services	0.15600	0.115	1.283	0.203
PGOVT - Percent Employed in Government	-0.03022	-0.015	-0.143	0.887
PCI - Per Capita Income	*-0.00040	*-0.323	*-2.593	*0.011
POPDEN - Population Density Per Square Mile	0.00626	0.047	0.196	0.845
EDUC - Percent Population High School Educ	*-0.25400	*-0.495	*-4.066	*0.000
EMPCHG - Employment Change 1990-2000	*0.00018	*0.431	*1.942	*0.056
F(8,92) = 7.701 p = 0.0001				
Durbin-Watson D = 1.977	Adjusted R^2 = 0.368			

Source: Research and Planning, MO Dept. of Economic Development.

Roughly 37% of children at risk scores in rural Missouri can be explained by three factors. First, it was found that higher percentages of people with a high school education decreased children at risk scores in rural counties. There is strong evidence that communities with higher levels of education are more likely to have lower incidence of children at risk (Ellwood 2000; Nord 1997). This may be attributable to differences in occupation and income, both of which are tied to educational attainment. This finding indicates that policy efforts to increase the number of people with a high school education would do much to lower the incidence of at risk children in rural areas.

Second, it was found that increases in total employment between 1990 and 2000 increased children at risk scores in rural counties. Although this may seem counter-intuitive, it may indicate that wage increases are more important than simple job creation. In addition, this finding may also be attributable to the prevalence of low wage job growth in several rural areas of the state. For example, low wage service jobs have grown markedly in Branson due to the entertainment and recreation industry; and low wage livestock processing jobs have grown in Milan and Sedalia - resulting in higher children at risk scores.

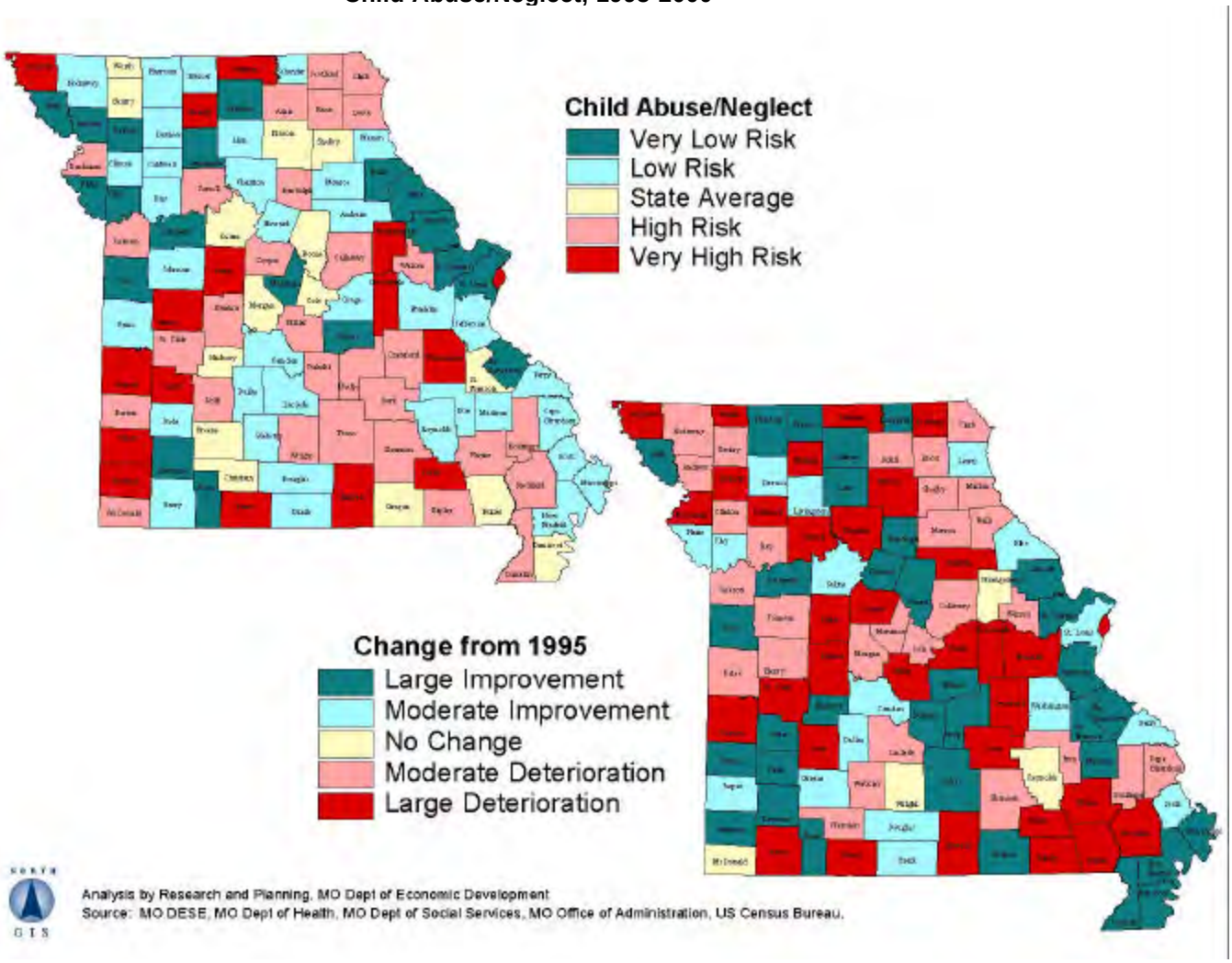
Third, it was found that higher per capita incomes decreased children at risk scores in rural counties. Per capita income is mainly an indicator of poverty, and there is strong evidence that poverty increases the incidence of children at risk in rural areas (Findes and Jensen 1998; Nord 1997). This finding indicates that increasing per capita incomes - through increases in wages and transfers - would lower the incidence of at risk children in rural areas.

In summary, it appears that children are least at risk in areas that have highly educated populations, lower job growth between 1990-2000, and higher per capita incomes. The results of this analysis indicate that economic conditions play a moderate role in explaining the incidence of at risk children in rural Missouri.

IV. Child Abuse and Neglect

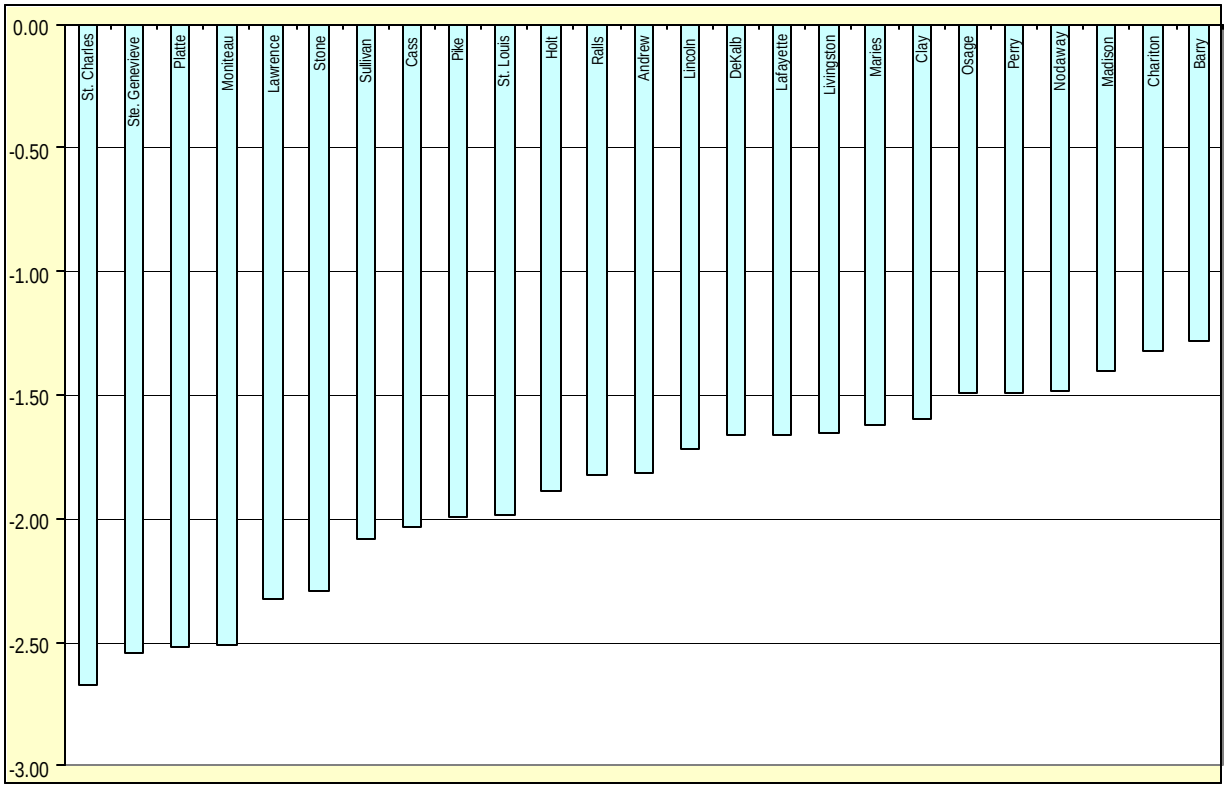
The Index of Child Abuse and Neglect measures the occurrence of child abuse and neglect across counties. High risk indicates that children may live in home environments that place them at risk for being abused or neglected. This environment may impact a child's future well-being in terms of health status. It appears that children are most at risk for child abuse/neglect in St. Louis City, southwest Missouri, south central Missouri, and northeast Missouri. Children appear least at risk in northwest Missouri, in portions of south central Missouri, and in areas along the Mississippi River. Refer to Map 2.

Map 2
Child Abuse/Neglect, 1995-2000



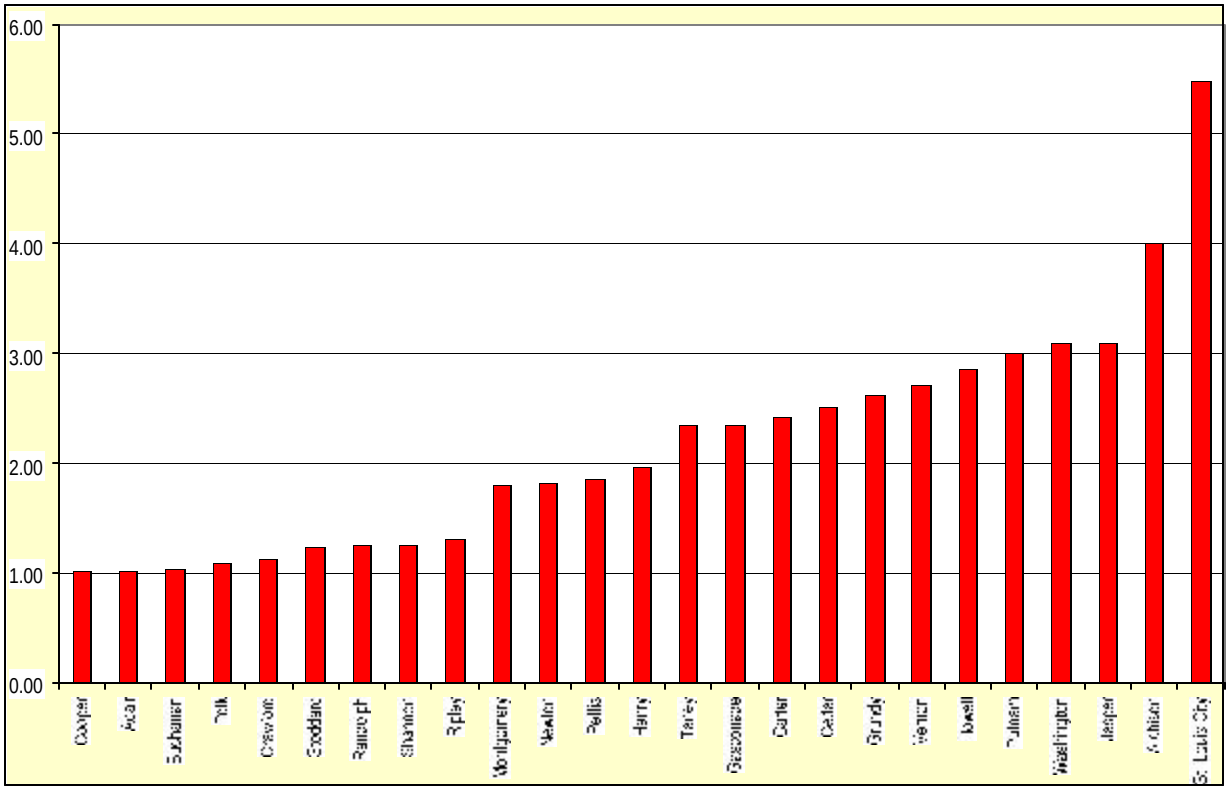
Children are least at risk for child abuse/neglect in four main regions of the state: (1) in areas along the Mississippi River from Hannibal south to suburban St. Louis; (2) Ste. Genevieve; (3) parts of northwest Missouri; and (4) areas along the Mississippi River from suburban St. Louis south to New Madrid County. The five counties with the lowest risk levels are St. Charles, Ste. Genevieve, Platte, Moniteau, and Lawrence counties. Generally, low risk of child abuse/neglect is diffused across the state. Refer to Chart 5.

Chart 5
Child Abuse/Neglect - Low Risk Counties, 2000



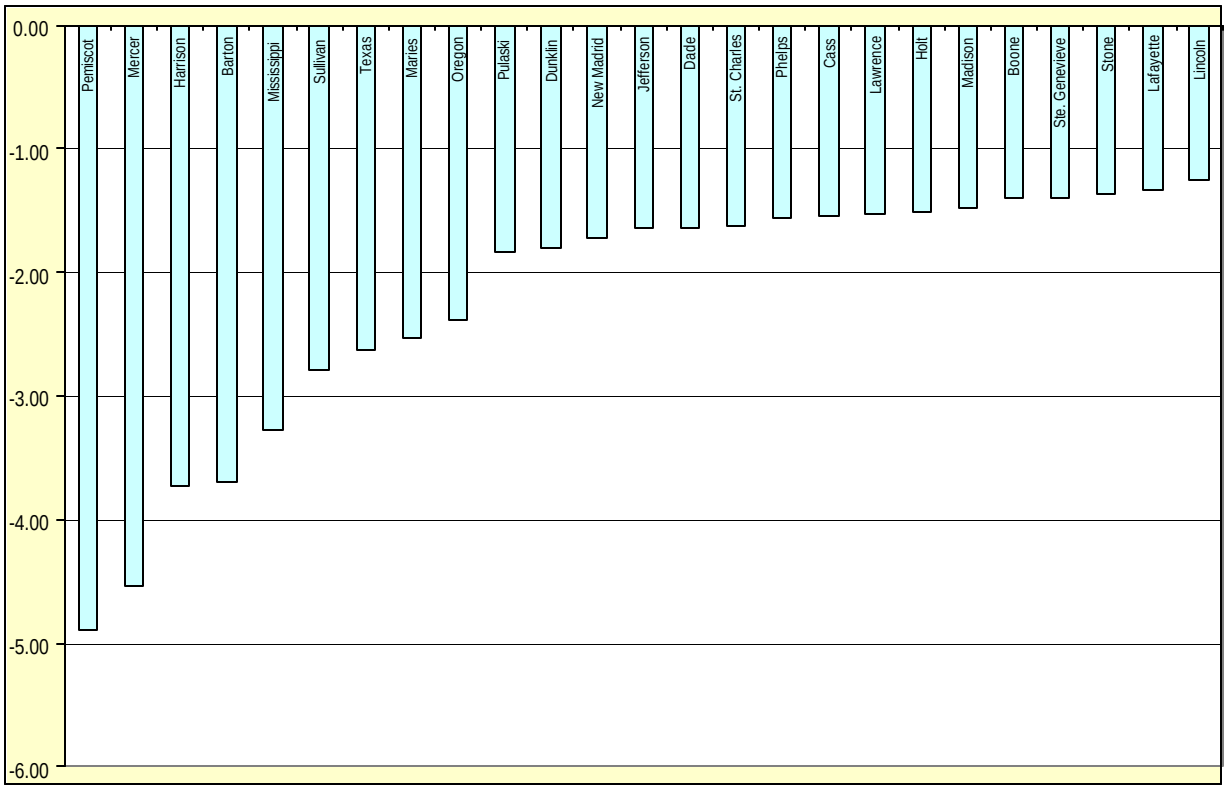
Children are most at risk for child abuse/neglect in four main regions of the state: (1) the City of St. Louis; (2) regional trade centers in southern Missouri, such as Nevada, Potosi, Sedalia, and West Plains; (3) extreme northeast Missouri; and (4) in several pockets in north Missouri, such as Atchison, Grundy and Putnam counties. The five counties with the highest risk levels for child abuse/neglect are St. Louis City, Atchison, Jasper, Washington, and Putnam counties. Historically, southern Missouri exhibits higher risk because it has lower levels of income and education than the rest of the state (Nord 1997). It also appears the regional trade centers exhibit higher risk levels. These include Joplin (Jasper County), Nevada (Vernon County), Potosi (Washington County), Trenton (Grundy County), and West Plains (Howell County). Refer to Chart 6.

Chart 6
Child Abuse/Neglect - High Risk Counties, 2000



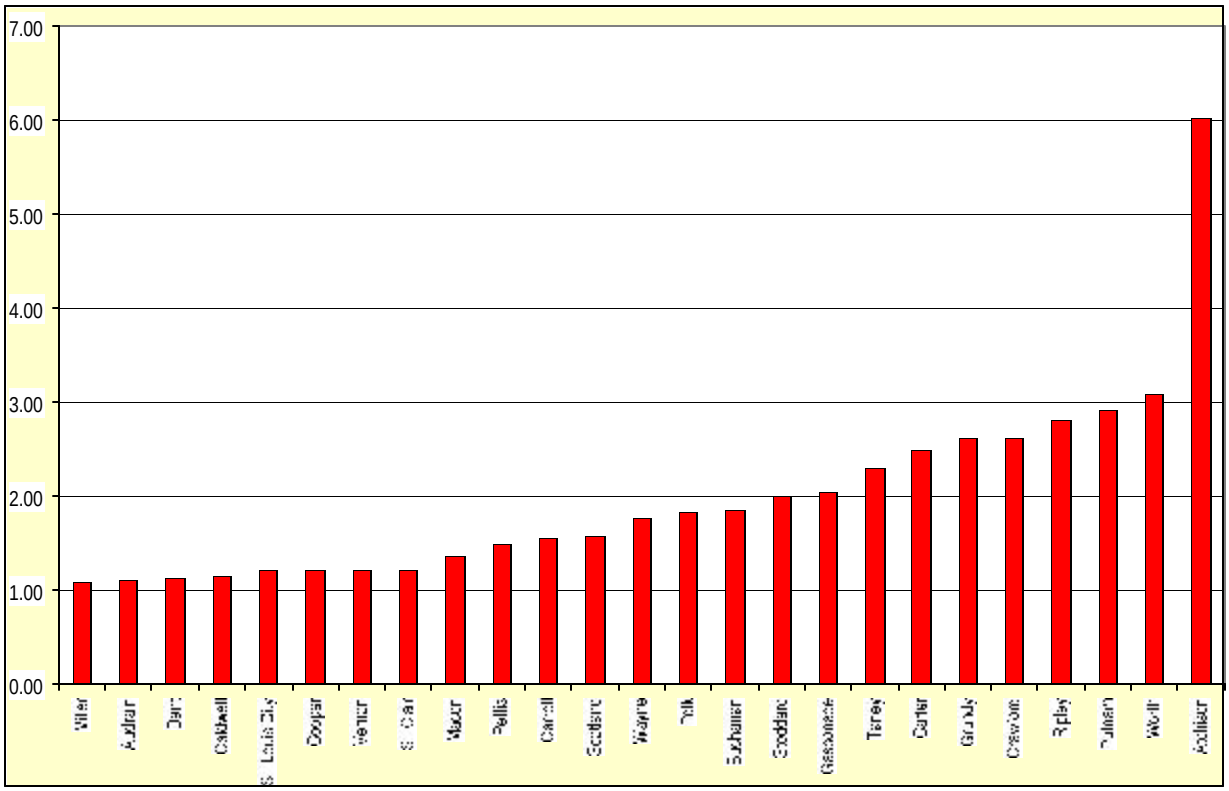
Since 1995, several counties have experienced marked improvement in their child abuse/neglect risk scores. Generally, these counties were concentrated in six main areas: (1) the Missouri Bootheel; (2) suburban St. Louis; (3) areas along US 67 from suburban St. Louis to Madison County; (4) pockets in north central Missouri; (5) the Columbia region; and (6) the Rolla region. The five counties with the largest improvement since 1995 are Pemiscot, Mercer, Harrison, Barton, and Mississippi counties. Improvement scores should be noted with caution in that it does not reflect current at-risk conditions. For example, although Cedar County improved markedly since 1995, it has the ninth highest risk level for child abuse/neglect. Refer to Chart 7.

Chart 7
Child Abuse/Neglect - High Improvement Counties, 1995-2000



Since 1995, several counties have experienced marked deterioration in their child abuse/neglect scores. Generally, these areas are diffused throughout most of the state, but were concentrated in three main regions: (1) in pockets in extreme northern Missouri; (2) southeast Missouri; and (3) the east central region along the Missouri River. The five counties with the largest deterioration since 1995 are Atchison, Worth, Putnam, Ripley, and Crawford counties. Historically, southern Missouri exhibits higher risk because it has lower levels of income and education than the rest of the state (Nord 1997). High deterioration in north Missouri may be attributable to growth in livestock processing facilities, which usually employ low-wage workers (Grambling and Freudenberg 1992). However, most counties in Missouri experienced some deterioration in child abuse/neglect scores. Refer to Chart 8.

Chart 8
Child Abuse/Neglect - High Deterioration Counties, 1995-2000



Regression Model

To determine how economic factors may influence child and teen welfare, an OLS regression model predicting child abuse/neglect risk scores was run on N=93 rural counties in Missouri. As stated previously, urban counties were excluded because they contain outliers on both high and low at risk children (i.e. St. Charles versus St. Louis City). The regression model is moderately significant at p=0.025 ($F_{0.025}(8,92) = 2.352$), however the model only explains 10.5% ($R^2_{adjusted} = 0.105$) of the variance in child abuse/neglect scores in 2000. This indicates that the model predicts child abuse/neglect scores with a poor degree of accuracy.

All OLS assumptions were met for the results to be the best linear unbiased estimates (refer to Appendix A). Only one variable was a statistically significant predictor of child abuse/neglect risk scores. It appears that higher percentages of people employed in the services sector (PSERV) increased child abuse/neglect risk scores ($b^* = 0.286$, $p=0.009$). This indicates that rural economies with a high percentage of service jobs may result in a higher incidence of child abuse/neglect, which is supported by the literature (Bartik and Eberts 1999). However, since the model predicts only 10.5% of the variance in child abuse/neglect scores, this finding should be taken with caution. In summary, the results of this analysis indicate that economic conditions play a very minor role in explaining the incidence of child abuse/neglect in rural Missouri. Refer to Table 2.

Table 2
OLS Regression Model Predicting
Child Abuse and Neglect in Rural Missouri, 2000

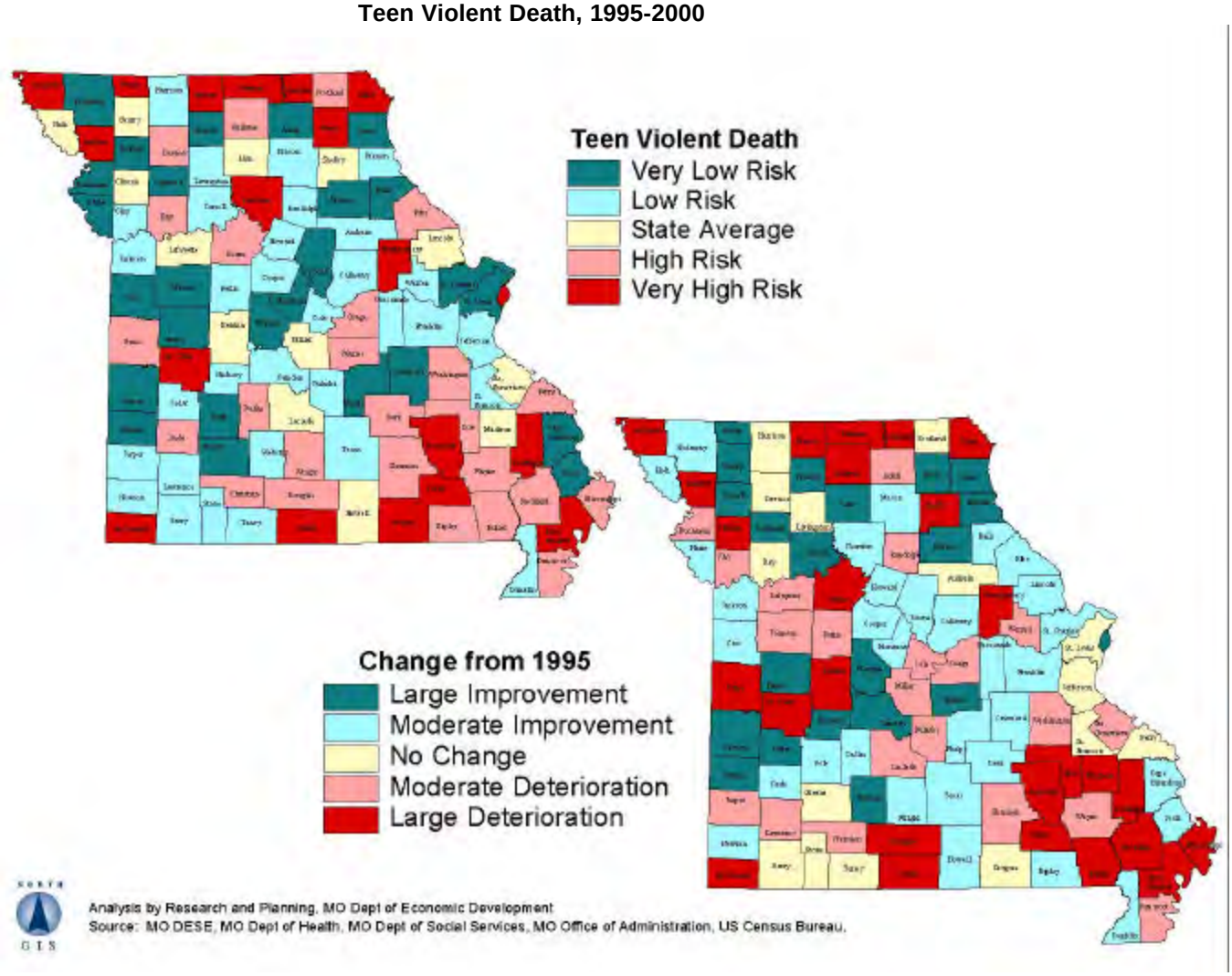
VARIABLE	PARAMETER ESTIMATES			
	Estimate	Std Estimate	T Statistic	Significance
INTERCEPT	0.24900	-	0.214	0.831
PAG - Percent Employed in Agric, Forestry	-0.03033	-0.174	-1.569	0.120
PMFGR - Percent Employed in Manufacturing	-0.00652	-0.045	-0.389	0.698
PSERV - Percent Employed in Services	*0.16100	*0.286	*2.683	*0.009
PGOVT - Percent Employed in Government	0.03479	0.042	0.332	0.741
PCI - Per Capita Income	-0.00012	-0.236	-1.592	0.115
POPDEN - Population Density Per Square Mile	-0.02500	-0.455	-1.578	0.118
EDUC - Percent Population High School Educ	0.02922	0.137	0.947	0.346
EMPCHG - Employment Change 1990-2000	0.00007	0.422	1.598	0.114
F(8,92) = 2.352 p = 0.025				
Durbin-Watson D = 1.948	Adjusted $R^2 = 0.105$			

Source: Research and Planning, MO Dept. of Economic Development.

V. Teen Violent Death

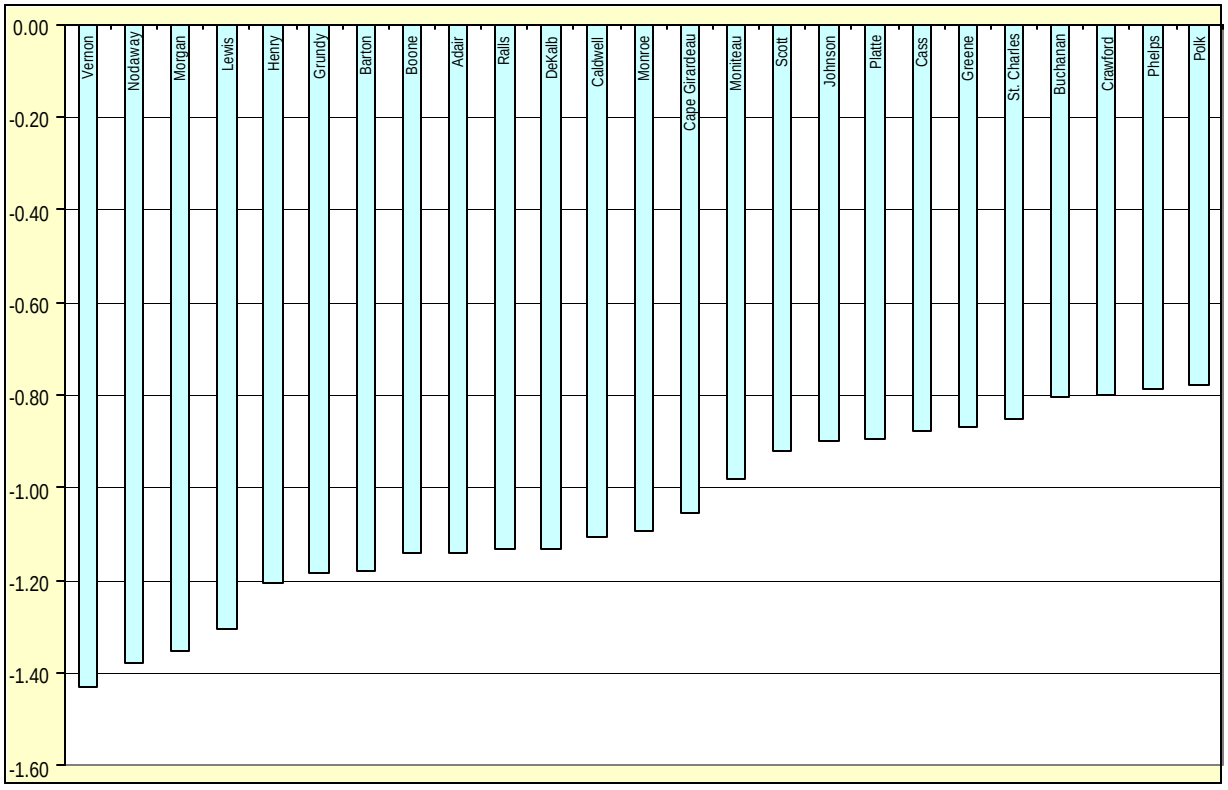
The Index of Teen Violent Death measures the rate of violent deaths to teens due to accidents, homicides and suicides. High risk indicates that teens may live in environments that place them at greater risk for dying violently. This excludes teen deaths attributable to natural causes, disease, or other medical conditions. This environment may impact a teen's future well-being in terms of educational attainment, health status, and delinquency. It appears that teens are most at risk for violent death in St. Louis City, southeast Missouri, and in extreme northern Missouri. Teens are least at risk in the metropolitan areas of the state and in central and southwest Missouri. In general, teen violent death is diffused throughout the state. Refer to Map 3.

Map 3
Teen Violent Death, 1995-2000



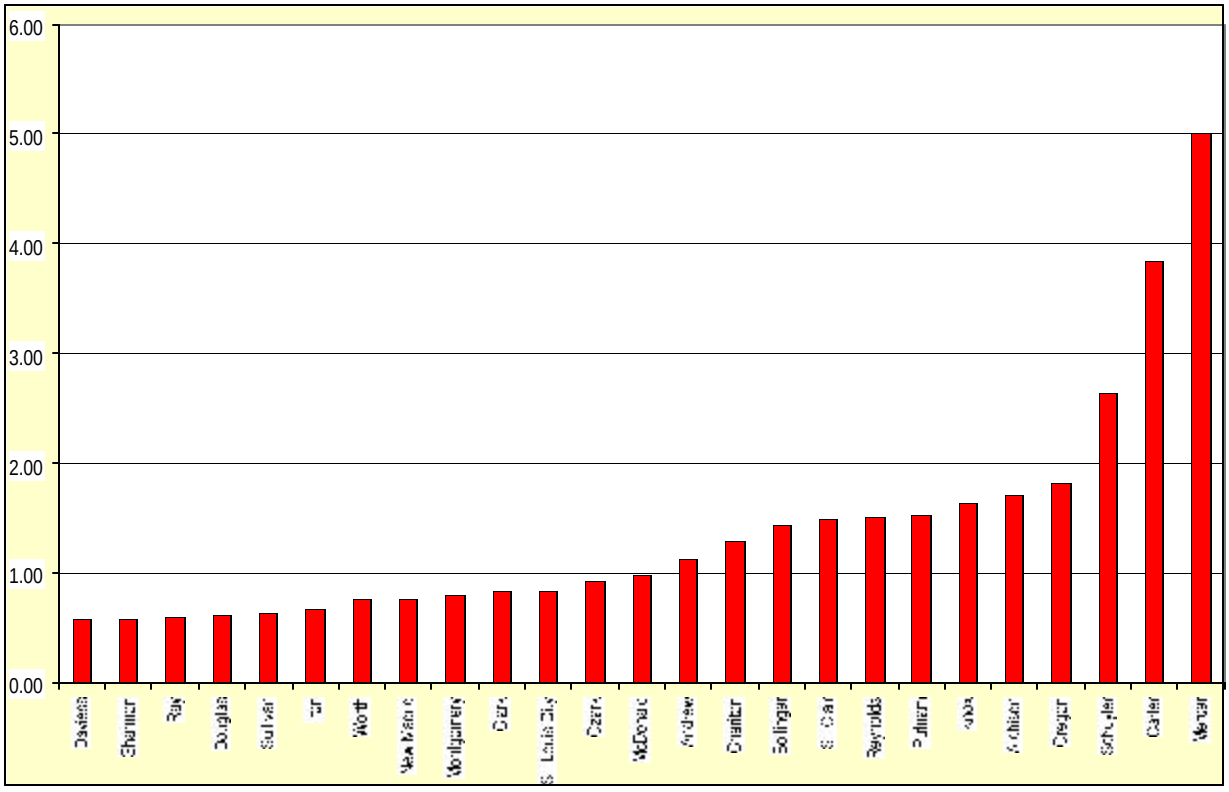
Teens are least at risk for violent death in three main regions of the state: (1) the larger metropolitan areas of the state, excluding St. Louis City, which include Columbia, Kansas City, Springfield, St. Joseph, and suburban St. Louis; (2) the micropolitan areas located in rural Missouri, which include Cape Girardeau, Kirksville, Nevada, and Rolla; and (3) central Missouri. The five counties with the lowest teen violent death rates are Vernon, Nodaway, Morgan, Lewis, and Henry counties. Generally, more urbanized areas exhibit low risk because of higher income and educational levels (Ellwood 2000; Nord 1997). Refer to Chart 9.

Chart 9
Teen Violent Death - Low Risk Counties, 2000



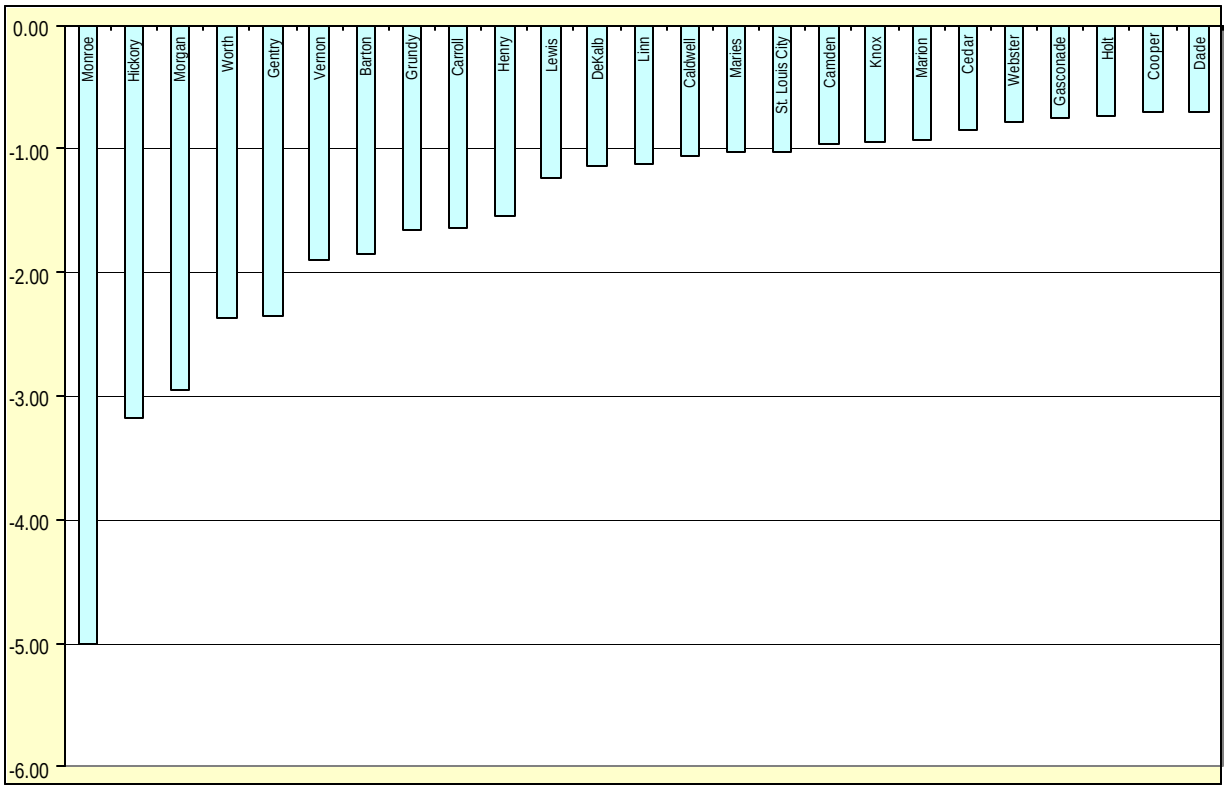
Teens are most at risk for violent death in three main regions of the state: (1) the City of St. Louis; (2) extreme northern Missouri; and (3) southeast Missouri. The five counties with the highest risk levels are Mercer, Carter, Schuyler, Oregon, and Atchison counties. High rates of teen violent death in north Missouri are most likely caused by agricultural and automotive accidents (Green 1985). The same is partially true for southern Missouri, but the area also exhibits higher risk because it has lower levels of income and education than the rest of the state (Nord 1997). Refer to Chart 10.

Chart 10
Teen Violent Death - High Risk Counties, 2000



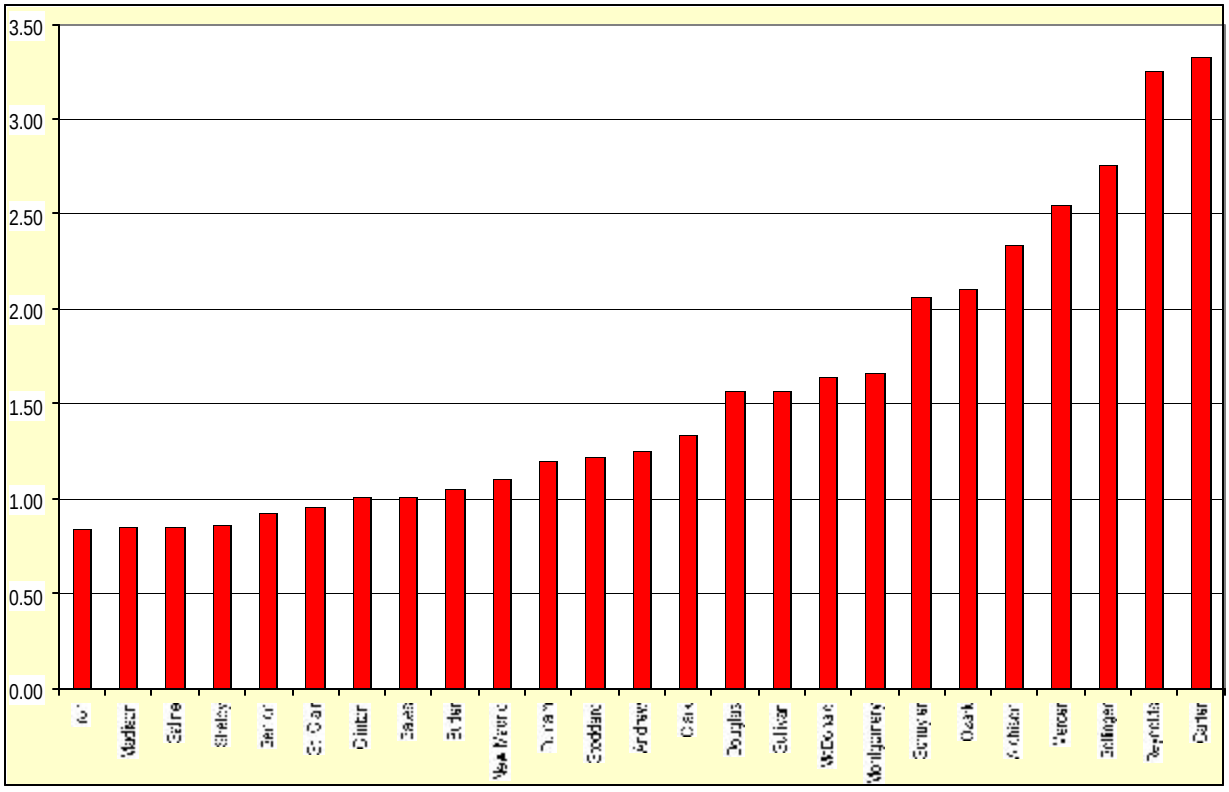
Since 1995, several counties have experienced marked improvement in their teen violent death rate scores. Generally, these counties were concentrated in five main areas: (1) St. Louis City; (2) northeast Missouri along the Mississippi River; (3) portions of the Lake Ozark region; (4) the Nevada region; and (5) portions of northwest Missouri. The five counties with the largest improvement since 1995 are Monroe, Hickory, Morgan, Worth, and Gentry counties. Improvement scores should be noted with caution in that it does not reflect current at-risk conditions. For example, although Knox improved markedly since 1995, it has the sixth highest teen death rate. Refer to Chart 11.

Chart 11
Teen Violent Death - High Improvement Counties, 1995-2000



Since 1995, several counties have experienced marked deterioration in their teen violent death rate scores. Generally, these counties were concentrated in three main areas: (1) the Missouri Bootheel; (2) north central Missouri; and (3) portions of the Truman Reservoir region. The five counties with the largest deterioration since 1995 are Carter, Reynolds, Bollinger, Mercer, and Atchison counties. Areas dependent on agriculture may exhibit higher teen violent death rates due to farming accidents, since many teens assist their family in the farm operation (Grambling and Freudenberg 1992). Also, areas dependent on water recreation may exhibit higher teen violent death rates due to boating accidents. Refer to Chart 12.

Chart 12
Teen Violent Death - High Deterioration Counties, 1995-2000



Regression Model

To determine how economic factors may influence child and teen welfare, an OLS regression model predicting teen violent death rate scores was run on N=93 rural counties in Missouri. As stated previously, urban counties were excluded because they contain outliers on both high and low at risk teens (i.e. St. Charles versus St. Louis City). The regression model is highly significant at p=0.0001 ($F_{0.0001}(8,92) = 8.449$), and explains 39.3% ($R^2_{adjusted} = 0.393$) of the variance in teen violent death rates in 2000. This indicates that the model predicts teen violent death rates with a moderate degree of accuracy.

All OLS assumptions were met for the results to be the best linear unbiased estimates (refer to Appendix A). The following variables were statistically significant predictors of teen violent death rates, and are listed according to the strength of their effect. First, it appears that higher percentages of people employed in agriculture and forestry (PAG) increased teen violent death rates (b* = 0.361, p=0.0001). Second, higher per capita incomes (PCI) decreased teen violent death rates (b* = -0.241, p=0.051). Lastly, higher percentages of people with a high school education or above (EDUC) decreased teen violent death rates - although the variable only approaches statistical significance (b* = -0.214, p=0.076). Refer to Table 3.

Table 3
OLS Regression Model Predicting
Teen Violent Deaths in Rural Missouri, 2000

VARIABLE	PARAMETER ESTIMATES			
	Estimate	Std Estimate	T Statistic	Significance
INTERCEPT	2.76300	-	3.848	0.000
PAG - Percent Employed in Agric, Forestry	*0.04715	*0.361	*3.945	*0.000
PMFGR - Percent Employed in Manufacturing	-0.00936	-0.086	-0.904	0.368
PSERV - Percent Employed in Services	0.03441	0.081	0.927	0.357
PGOVT - Percent Employed in Government	0.02826	0.045	0.436	0.664
PCI - Per Capita Income	*-0.00009	*-0.241	*-1.979	*0.051
POPDEN - Population Density Per Square Mile	0.00148	0.036	0.152	0.880
EDUC - Percent Population High School Educ	*-0.03426	*-0.214	*-1.796	*0.076
EMPCHG - Employment Change 1990-2000	-0.00002	-0.172	-0.790	0.432
F(8,84) = 8.449 p = 0.0001				
Durbin-Watson D = 1.960	Adjusted R^2 = 0.393			

Source: Research and Planning, MO Dept. of Economic Development.

Roughly 39% of teen violent death rates in rural Missouri can be explained by three factors. First, it was found that higher percentages of people employed in agriculture and forestry increased teen violent death rates in rural counties. This finding may be attributable to the higher rate of accidents that occur on farms (Grambling and Freudenberg 1992; Green 1985). For example, there is a high rate of teen violent deaths in north Missouri, an area heavily dependent on agriculture. Another factor that may cause higher teen violent deaths in rural Missouri is automobile accidents. Since rural teens often have to drive longer distances to attend school or other activities, this may lead to a higher death rate (Grambling and Freudenberg 1992). This finding indicates that areas dependent on agriculture should take steps to prevent teen deaths - mainly through farm safety programs and expanded transportation services.

Second, it was found that higher per capita incomes decreased teen violent death rates in rural counties. Per capita income is mainly an indicator of poverty, and there is strong evidence that poverty increases the incidence of teen delinquency in rural areas (Ellwood 2000; Nord 1997). This finding indicates that increasing per capita incomes - through increases in wages and transfers - would lower the incidence of teen violent deaths in rural areas.

Lastly, it was found that higher percentages of people with a high school education decreased teen violent death rates in rural counties. There is strong evidence that communities with higher levels of education are more likely to have lower incidence of teen delinquency (Ellwood 2000; Nord 1997). This may be attributable to differences in occupation and income, both of which are tied to educational attainment. This finding indicates that policy efforts to increase the number of people with a high school education would do much to lower the incidence of teen violent death rates in rural areas. It should be noted that this finding only approached statistical significance, and should be taken with caution.

In summary, it appears that teens are least at risk from violent death in areas that are not dependent on agriculture or forestry, that have higher per capita incomes, and that are more highly educated. The results of this analysis indicate that economic conditions play a moderate role in explaining teen violent death rates in rural Missouri.

VI. Summary and Implications

Research and Planning with the Missouri Department of Economic Development created three indicators of child and teen welfare that are statistically reliable using available longitudinal data with county specificity. The three indicators measure Children At Risk, Child Abuse and Neglect and Teen Violent Death. These indicators will allow policy makers to track the current state of child and teen well-being at the county level over time.

The Index of **Children At Risk** measures the environmental conditions present that may affect the economic and social well-being of children. It appears that children are most at risk in southern Missouri, particularly in the Bootheel region. Children are least at risk in northwestern Missouri and in areas along the eastern portion of the Missouri River.

Roughly 37% of children at risk scores in rural Missouri can be explained by three factors. It appears that children are least at risk in areas that have highly educated populations, lower job growth between 1990-2000, and higher per capita incomes. The results of this analysis indicate that economic conditions play a moderate role in explaining the incidence of at risk children in rural Missouri.

The Index of **Child Abuse and Neglect** measures the occurrence of child abuse and neglect across counties. It appears that children are most at risk for child abuse/neglect in St. Louis City, southwest Missouri, south central Missouri, and northeast Missouri. Children appear least at risk in northwest Missouri, in portions of south central Missouri, and in areas along the Mississippi River.

It was found that rural economies with a high percentage of service jobs may result in a higher incidence of child abuse/neglect, which is supported by the literature (Bartik and Eberts 1999). However, since the model predicts only 10.5% of the variance in child abuse/neglect scores, this finding should be taken with caution. In short, the results of this analysis indicate that economic conditions play a very minor role in explaining the incidence of child abuse/neglect in rural Missouri.

The Index of **Teen Violent Death** measures the rate of violent deaths to teens due to accidents, homicides and suicides. It appears that teens are most at risk for violent death in St. Louis City, southeast Missouri, and in extreme northern Missouri. Teens are least at risk in the metropolitan areas of the state and in central and southwest Missouri. In general, teen violent death is diffused throughout the state.

Roughly 39% of teen violent death rates in rural Missouri can be explained by three factors. It appears that teens are least at risk from violent death in areas that are not dependent on agriculture or forestry, that have higher per capita incomes, and that are more highly educated. The results of this analysis indicate that economic conditions play a moderate role in explaining teen violent death rates in rural Missouri.

In summary, the findings presented in this report will allow policy makers to assess the current state of child and teen welfare in their area; and to track changes over time. The findings of this report will also allow policy makers to see what impact economic factors have on child and teen welfare. This will allow economic development agencies to ascertain whether the economy has any impact on child and teen welfare, and to act accordingly.

References

Bartik, T. and R. Eberts. 1999. "Examining the Effect of Industry Trends and Structure on Welfare Caseloads." In *Economic Conditions and Welfare Reform*, edited by S. Danziger. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Ellwood, D. 2000. "Anti-Poverty Policy for Families in the Next Century." *The Journal of Economic Perspectives* 14(1): 187-198.

Findes J. and L. Jensen. 1998. "Employment Opportunities in Rural Areas: Implications for Poverty in a Changing Policy Environment." *American Journal of Agricultural Econo*mics 80(5): 1000-1008.

Grambling, R. and W.R. Freudenberg. 1992. "Opportunity-Threat, Development and Adaptation: Toward a Comprehensive Framework for Social Impact Assessment." *Rural Sociology* 57: 216-234.

Green, G.P. 1985. "Large Scale Farming and the Quality of Life in Rural Communities: Further Specification of the Goldschmidt Hypothesis." *Rural Sociology* 50: 262-274.

Kusmin, Lorin D. 1994. *Factors Associated with the Growth of Local and Regional Economies: A Review of Selected Empirical Literature.* Economic Research Service, United States Department of Agriculture – AGES 9405. USDA: Washington, DC.

Kusmin, Lorin D., J.M. Redman and David W. Sears. 1996. *Factors Associated with Rural Economic Growth: Lessons from the 1980s.* Economic Research Service, United States Department of Agriculture – TB 1850. USDA: Washington, DC.

Nord, M. 1997. "Overcoming Persistent Poverty - And Sinking Into It: Income Trends in Persistent Poverty and Other High Poverty Rural Counties." *Rural Development Perspectives* 12(3): 2-30.

Rhodes, V.J. 1995. "The Industrialization of Hog Production." *Review of Agricultural Economics* 17: 107-118.

Appendix A

Econometric Methodology

Generally speaking, regression centers on the notion that we wish to predict the value on some variable (known as the endogenous variable) knowing the values of several other variables (known as exogenous variables). Usually, the best guess for predicting a value on the endogenous variable is the mean, but this produces some amount of error due to the inaccuracy of prediction. Regression improves this accuracy by taking into account additional information (control and predictor exogenous variables) in order to more accurately predict values on the endogenous variable. By doing so, you reduce the amount of error associated with only predicting the mean. Therefore, an Ordinary Least Squares (OLS) regression equation is a mathematical representation of an estimation rule that seeks to minimize the amount of error in prediction. Also, regression deals with the dependence of one variable on other variables, so it does not establish true causation. Regression is a stochastic process in which there is some error in prediction and estimation.

The general model used to predict child and teen welfare is:

$$Y_i = b_0 + b_1PAG + b_2PMFGR + b_3PSERV + b_4PGOVT + b_5PCI + b_6POPDEN + b_7EDUC + b_8EMPCHG$$

Where:

- **Y_i** is the child and teen welfare indicator for 2000. All three are interval-ratio variables.
  Source: Annie E. Casey Foundation, OSEDA University of Missouri.
- **b_1PAG** is the percent labor force employed in agriculture, forestry and fishing.
  Source: ES-202, Missouri Department of Economic Development.
- **b_2PMFGR** is the percent labor force employed in manufacturing.
  Source: ES-202, Missouri Department of Economic Development.
- **b_3PSERV** is the percent labor force employed in services.
  Source: ES-202, Missouri Department of Economic Development.
- **b_4PGOVT** is the percent labor force employed in government.
  Source: ES-202, Missouri Department of Economic Development.
- **b_5PCI** is per capita income from all sources.
  Source: Bureau of Economic Analysis, US Department of Commerce.
- **b_6POPDEN** is the population density per square mile.
  Source: ESRI and US Bureau of the Census.
- **b_7EDUC** is the percent population with a high school education or higher.
  Source: EASI.
- **b_8EMPCHG** is the change in total employment between 1990 and 1999.
  Source: ES-202, Missouri Department of Economic Development.

The results of the regression models are the best linear unbiased estimates, since they meet the key assumptions of OLS regression:

(1) *Random Endogenous Variable*: the values of the endogenous variables are produced by chance, and were not chosen a priori.
(2) *Normal Endogenous Variable*: all three endogenous variables had a normal probability distribution (skewness and kurtosis less than 2.0 on all variables).
(3) *Linearity*: plots of each exogenous variable by each endogenous variable showed no curvilinear pattern.
(4) *Independent Errors*: the error terms for all OLS models were not correlated, a possible problem with time-series data. The Durbin-Watson statistic was run on all OLS models, and values were around 2.00 indicating no serial correlation (Durbin-Watson D falls between D_U=2.285 and D_L=1.715).
(5) *Homoscedasticity*: the variance of the error terms for all OLS models are constant across the full range of exogenous variables. White's test was not significant for all OLS models, indicating that generalized heteroscedasticity is not present. Plots of the residuals of the endogenous variables by each exogenous variables revealed normally distributed error terms, indicating that systematic heteroscedasticity is not present.
(6) *No Multicollinearity*: no linear relationships were found among the variables. An examination of the correlation matrix indicated no r-value above 0.7.
(7) *Model Specified Correctly*: the variables chosen for the model have been validated by other researchers (Kusmin et al. 1996; Kusmin 1994).

Metropolitan Areas Excluded from the Analysis
Shaded Areas

RAP-0301-1

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